

air, and must, therefore, be kept in damp surroundings. On the other hand, excess of moisture encourages the growth of micro-organisms in the mucus with which the eggs are frequently covered when laid, and such foreign growths tend to the destruction of the contents.

On the whole, the general features of the development are closely similar to those in other lizards; I propose, therefore, to reserve the details until a complete account can be given. I may, however, mention that the pineal eye becomes a prominent feature at an early stage. When pigment is deposited in the skin, an oval spot is left free from it over the eye, and through this the dark pigment of the retina shows clearly. Spencer* has stated that there is in *Sphenodon* very little external trace of the pineal eye. This is true of the adult, but in the recently hatched tuatara the pineal eye still shows as a dark spot through the translucent skin over the parietal foramen. This I have been able to observe even in a tuatara 8 inches in length. But as the tuatara grows older the skin over the pineal eye becomes more opaque, and though in some individuals the scantier development of the pigment over the parietal foramen affords a feeble indication of the position of the eye, yet in others the pigment is deposited there as elsewhere, so that all external trace of the eye is finally lost.

- V. "On the Position of the Vocal Cords in Quiet Respiration of Man, and on the Reflex-Tonus of their Abductor Muscles." By FELIX SEMON, M.D., F.R.C.P., Assistant Physician in charge of the Throat Department of St. Thomas's Hospital, and Laryngologist to the National Hospital for Epilepsy and Paralysis, Queen Square. Communicated by Professor VICTOR HORSLEY, F.R.S. Received May 25, 1890.

(Abstract.)

The investigation which forms the subject of this paper was undertaken with a view of settling, if possible, the moot question whether in man the larynx during quiet respiration plays an active rôle or not, and, if the former, what is its function?

For this purpose the author has examined, by means of graduated mirrors, the size of the glottis during quiet respiration in fifty adult trained healthy persons, and, after death, in twenty-five adult bodies. The method of the examination and the precautions necessary to guard against possible fallacies are fully described in the paper. A comparison of the measurements thus obtained shows that in less than 20 per cent. the vocal cords during quiet respiration perform

* 'Quart. Journ. Microsc. Science,' vol. 27, p. 176.

rhythmical movements synchronous with inspiration and expiration, and that in more than 80 per cent. the glottis in both sexes forms during quiet respiration an isosceles triangle, 2—3 times as large on the average as that representing the cadaveric glottis. Under all circumstances the minimum size observed during life is larger than the maximum seen after death.

Additionally corroborative literary and experimental evidence (from experiments on animals) is adduced, showing that the glottis in man during quiet respiration is considerably wider open than after death.

The position of the vocal cords during quiet respiration, therefore, represents neither a state of inaction of their antagonistic adductor and abductor muscles nor a condition of equilibrium between them. It must necessarily be the result of actual muscular contraction, and must represent either simultaneous activity of both the adductors and abductors, with preponderance of the latter; or, secondly, some degree of activity on the part of the latter alone, the adductors being not at all in a state of functional activity.

Prior to discussing the question which of these two possibilities corresponds to the actual facts, the author investigates the *cause* of the difference found to exist between the conditions observed during life and after death. He draws attention to the fact that the larynx serves two functions, in a certain sense antagonistic to each other, viz., those of respiration and phonation. For the purposes of the former it is indispensable that the lumen of the air-tubes should be wide enough to admit of the ingress and egress of the quantity of air necessary for breathing purposes; for those of the latter, that an apparatus should be interpolated within the air-tubes which would admit of a complete juxtaposition of the voice-producing organs.

It is then shown by another series of comparative measurements that by the interpolation of the vocal apparatus (which for reasons derived from comparative anatomy must be considered to be a highly specialised addition to the respiratory system) within the air-passages their narrowest part is further reduced, when the vocal cords are at perfect rest ("cadaveric position"), to less than one-third of its natural area; and, again, by a review of experimental and pathological facts, that a reduction of the glottis to this cadaveric size involves, upon the commencement of any effort, however small, some alteration in the type of respiration.

From these facts the conclusion is drawn that the interpolation of the phonatory within the respiratory apparatus had to be counter-balanced by some arrangement which supplied the minimum of space compatible with the ingress and egress of that amount of air into the lower air-passages which is required for the purposes of what we call normal quiet respiration.

This arrangement could consist either in a rhythmical opening of the glottis synchronous with each inspiration, or in a tonic dilatation of the glottic space during both phases of respiration.

It having been shown that, though both these alternatives are actually met with, the latter is much more representative of the participation of the larynx in quiet respiration of man than rhythmic movements, it remained to be investigated, as previously mentioned, whether this tonic widening represents a state of tonic innervation of both the glottis-openers and glottis-closers, with preponderance of the former, or, on the other hand, a tonic innervation of the glottis-openers alone.

This question is discussed at length, and from anatomical, physiological, pathological, and experimental reasons the conclusion is arrived at that the glottis-openers (posterior crico-arytænoid muscles) *alone* are, during life, in a state of semi-tonic contraction.

The only remaining question, viz., whether this tonus is automatic or reflex, is answered, on the basis of experimental evidence, to the effect that in all probability the tonus of the abductor muscles is of a *reflex* character, and that the impulses acting upon their ganglionic, *i.e.*, bulbar, centres, are mainly, though not exclusively, conducted along the pneumogastric nerves. The experiments upon which this conclusion is based (division of the pneumogastric nerves below the points from which the recurrent laryngeal nerves are given off), and which were kindly performed for the author by Professor Victor Horsley, are communicated in full in the paper.

The final conclusions arrived at by the author are as follows:—

1. The glottis in man is wider open during quiet respiration (inspiration and expiration) than after death or after division of the vagi or recurrent laryngeal nerves.

2. This wider opening during life is the result of a permanent activity of the abductors of the vocal cords (posterior crico-arytænoid muscles), which therefore belong not merely to the class of accessory, but of regular respiratory, muscles.

3. The activity of these muscles is due to tonic impulses, which their centres receive from the neighbouring respiratory centre in the medulla oblongata. It is very probable that these impulses rhythmically proceed to the respiratory centre from the stimulation of certain afferent fibres contained mainly, but not exclusively, in the trunks of the pneumogastric nerves, and that they are in the respiratory centre changed into tonic impulses. The regular activity of the abductors of the vocal cords during life, therefore, belongs to the class of reflex processes. The permanent half-contraction of these muscles, in which form their tonic innervation is manifested, can be further increased, in concord with the general laws of the mechanism of respiration, by either volition or other reflex influences.

4. In spite of their extra-innervation, the abductors of the vocal cords are physiologically weaker than their antagonists.

5. These antagonists, the adductors of the vocal cords, have primarily nothing at all to do with respiration, and ordinarily serve the function of phonation only. Their respiratory functions are limited to—

(a.) Assistance in the protection of the lower air passages against the entry of foreign bodies.

(b.) Assistance in the modified and casual forms of expiration known as cough and laughing.

VI. "A Record of the Results obtained by Electrical Excitation of the so-called Motor Cortex and Internal Capsule in an Orang Outang (*Simia satyrus*).” By CHARLES E. BEEVOR, M.D., F.R.C.P., and VICTOR HORSLEY, B.S., F.R.S. (From the Laboratory of the Brown Institution.) Received June 5, 1890.

(Abstract.)

Having been engaged for some time in investigating the representation of motor function in the cortex of the bonnet monkey, we thought it advisable to perform the same in an anthropoid as likely thereby to gain a closer insight into the modes of representation in man.

We first describe the peculiarities noticeable in the configuration of the convolutions in the orang.

As in the bonnet monkey, after narcotisation with ether, we divided the cortex into squares of 2 millimetres side, and excited the same with minimal stimuli from the secondary coil of an inductorium.

General Results.—The mode of representation of motor function was found to be highly specialised. The general plan was identical with that seen in the bonnet monkey in that the representation of each segment and part of the body in the orang was arranged in the same order as that according to which we found the representation of the primary movements to be grouped in the macaque monkey.

In addition to this, the areas for the representation of the different parts of the body we found not to be continuous with each other, but that between the areas of representation (for instance, of the face and the upper limb) there were regions of inexcitable cortex showing a degree of differentiation not obtained in the lower monkey.

A further remarkable evidence of specialisation was noticeable in